



**Riverby Edition**

**THE WRITINGS OF  
JOHN BURROUGHS**

**WITH PORTRAITS AND MANY ILLUSTRATIONS**

**VOLUME XIX**







THE WRITINGS  
OF  
JOHN BURROUGH  
XIX  
UNDER THE APPLE-TREES



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## PREFACE

I AM quite certain that the majority of my readers would have me always stick to natural history themes. I sympathize with them. I am myself never so well pleased as when I can bring them a fresh bit of natural history, or give them a day with me in the fields and woods or along the murmuring streams. Birds and squirrels come home to us all in a way that speculative ideas do not. While writing my more philosophical dissertations, my mind often turns longingly toward the simple outdoor subjects which have engaged me so many years, and doubtless the mind of my reader does also when he is perusing them. But one cannot always choose at such times. Natural history is a matter of observation; it is a harvest which you gather when and where you find it growing. Birds and squirrels and flowers are not always in season, but philosophy we have always with us. It is a crop which we can grow and reap at all times and in all places, and it has its own value and brings its own satisfaction.

We are all philosophers, we all delight in finding the reason of things and in tracing the relation of things, and to know, for instance, what part chance plays in our lives, and what part is played by rigid law, is a worthy and engaging problem. I do not

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flatter myself that I can resolve it, or any other similar question, but I find the effort stimulating, and now and then I get a gleam of light.

We live in a wonderful world, and the wonders of the world without us are matched and more than matched by the wonders of the world within us. This interior world has its natural history also, and to observe and record any of its facts and incidents, or trace any of its natural processes, is well worthy of our best moments.

I have given the name of the initial chapter, "Under the Apple-Trees," to the whole collection, because most of the essays were written in my camp under the trees, in the old orchard where I gathered apples as a farm-boy. The wild life about me appealed to my love of natural history, while thoughts and suggestions from beyond the horizon occupied my more philosophical meditations.

JOHN BURROUGHS.



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# I

## UNDER THE APPLE-TREES

### PART I

**T**HERE are few places on the farm where there is so much live natural history to be gathered as in the orchard. All the wild creatures seem to feel the friendly and congenial atmosphere of the orchard. The trees bear a crop of birds, if not of apples, every season. Few are the winged visitors from distant climes that do not, sooner or later, tarry a bit in the orchard. Many birds, such as the robin, the chippy, the hummingbird, the cedar-bird, the goldfinch, and some of the flycatchers, nest there. The great crested flycatcher loves the old hollow limbs, and the little red owl often lives in a cavity in the trunk. The jays visit the orchard on their piratical excursions in quest of birds' eggs, and now and then they discover the owl in his retreat and set up a great hue and cry over their discovery. On such occasions they will take turns in looking into the dim cavity and crying, "Thief, thief!" most vociferously, the culprit meanwhile, apparently, sitting wrapped in utter oblivion.

In May and June the cuckoo comes to the orchard for tent caterpillars, and the woodpeckers come at

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all seasons — the downy and the hairy to the good of the trees, the yellow-bellied often to their injury. The two former search for the eggs and the larvæ of the insects that infest the trees, as do the nut-hatches and the chickadees, which come quite as regularly; but the yellow-bellied comes for the life-blood of the trees themselves. He is popularly known as the “sapsucker,” and a sapsucker he is. Many apple-trees in every orchard are pock-marked by his bill, and occasionally a branch is evidently killed by his many and broad drillings. As I write these lines, on September the 26th, in my bush tent in one of the home orchards, a sapsucker is busy on a veteran apple-tree whose fruit has often gone to school with me in my pockets during my boyhood days on the farm. He goes about his work systematically, visiting now one of the large branches and then a portion of the trunk, and drilling his holes in rows about a quarter of an inch apart. Every square foot of the trunk contains from three hundred to four hundred holes, new and old, cut through into the inner, vital cambium layer. The holes are about the size of the end of a rye-straw, and run in rings around the tree, the rings being about a half an inch apart. The newly cut ones quickly fill with sap, which, to my tongue, has a rather insipid taste, but which is evidently relished by the woodpecker. He drills two or three holes, then pauses a moment, and when they are filled

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sips his apple-tree tippie leisurely. The drain upon the vitality of the tree at any one time, by this tapping, cannot be very serious, but in the course of years must certainly affect its vigor considerably. I have seen it stated in print, by a writer who evidently draws upon his fancy for his facts, that in making these holes the bird is setting a trap for insects, and that these are what it feeds upon. But the bird is a sapsucker; there are no insects at his wells to-day; he visits them very regularly, and is constantly drilling new ones.

His mate, or at least a female, comes, and I overhear the two in soft, gentle conversation. When I appear upon the scene, the female scurries away in alarm, calling as she retreats, as if for the male to follow; but he does not. He eyes me for a moment, and then sidles round behind the trunk of the tree, and as I go back to my table I hear his hammer again. Very soon the female is back and I hear their conversation going on as before. Day after day the male is here tapping the trees. His blows are soft and can be heard only a few yards away. He evidently has his favorites. In this orchard of twenty or more trees, only two are worked now, and only three have ever been worked much. The two favorites bear hard, sour fruit. The bark of a sweet apple-tree does not show a single hole. A grafted tree shows no holes on the original stock, but many punctures on the graft. One day I saw the bird

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frequently leave his drilling on one tree and go to another, drilling into a small red apple which had lodged among some twigs on a horizontal branch; he ate the pulp, and had made quite a large hole in the apple, when it became dislodged and fell to the ground. It is plain, therefore, that the sapsucker likes the juice of the apple, and of the tree that bears the apple. He is the only orchard bird who is a tippler. Among the forest trees, he sucks the sap of the sugar maples in spring, and I have seen evidence of his having drilled into small white pines, cutting out an oblong section from the bark, apparently to get at the soft cambium layer.

It is a pleasant experience to sit in my orchard camp of a still morning and hear an apple drop here and there—"indolent ripe," as Whitman says, in the fullness of time, or prematurely ripe from a worm at its heart. The worm finds its account in getting down to the ground where it can pupate, and in both cases the tree has finished a bit of its work and is getting ready for its winter sleep; and in both cases the squirrels and the woodchucks profit by the fall. But September woodchucks are few; most of them retire to their holes for the long winter sleep during this month; the harvest apples that fall in August hit them at the right moment; but the red squirrels are alert for the apple-seeds during both months, and they chip up many apples for these delicate morsels. They also love the hollow branches and

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trunks of the trees, in which they make their homes.

Little currents of wild life hourly flow about me. Yesterday, amid the slow rain and mist and general obscurity, there was suddenly an influx of birds in all the old apple-trees about me. Robins appeared by twos and threes in some choke-cherry bushes a few yards below me, and with much cackling and fluttering helped themselves to the fruit. A hermit thrush perched on a dry limb in front of my tent and in many different postures surveyed me in my canvas cavern, uttering a low note which I took to be his comments upon me. You may always know the hermit thrush from the other thrushes by that peculiar, soft, breathing motion of its tail. A male redstart came and flitted and flashed about the apple-branches without heeding me at all. Whitman asks:—

“Do you take it I would astonish?

Does the daylight astonish? does the early redstart  
twittering through the woods?

Do I astonish more than they?”

The redstart, with his black-and-orange suit, and his quick, lively motions, does not astonish, but few birds give the eye more pleasure. How gay and festive he looks, darting and flashing amid the gnarled and scaly branches of the decaying apple-trees! It seems as if all his motions were designed to show off his plumage to the best advantage.



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With tail slightly raised and spread, and wings a little drooping, he springs and swoops here and there in the trees — a bit of black holding and momentarily revealing a flame of orange. Redstart is a good name for him, as we see his colors only when he is in motion. Note our other black-and-orange bird, the Baltimore oriole; its color is conspicuous while the bird is at rest. Another brilliantly colored bird, the scarlet tanager, is seen from afar when quietly perched. He shows amid the green leaves like a burning coal; and his motions are all slow and deliberate when contrasted with those of the redstart. The latter is a fly-catcher, or insect-catcher, and his movements are necessarily sudden and rapid.

The birds are quite likely to go in troops in late summer or early fall, different species apparently being drawn along by a common impulse.

While the robins and the hermit thrush are among the choke-cherries, a family of indigo-birds, five or six of them, all of the brown color of the mother bird, are grouped around the mother on a flat stone for half a minute, being fed. It is a pretty little tableau. The father bird with his bright plumage is not in evidence. In one of the trees another warbler which I cannot identify, with an olive back and a yellow front, is in a great hurry about its own business. One little olive-green warbler, doubtless a young bird, comes and perches on the

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edge of my table, and, quite oblivious of my presence, looks my papers and books over for the insect tidbit which he does not find. How round and brilliant and eager are his eyes! If he is looking for a bookworm, he fails to find it.

A phoebe-bird perches here and there and makes sudden swoops to the ground for the insects which she cannot find on the wing. Phoebe hunts by sight at long range. Her eye seems telescopic, rather than microscopic like the warbler's. She explores the air and the ground and sees her game from afar. At all hours of the day she perches on the brown dead branches of the apple-trees, and waits for her prey to appear, her straight, stiff tail hingeing up and down at her rump.

At present my favorite denizen of the orchard is the chipmunk. He, too, likes the apple-seeds, but he is not given to chipping up the apples as much as is the red squirrel. He waits till the apples are ripe and then nibbles the pulp. He also likes the orchard because it veils his movements; when making his trips to and fro, if danger threatens, the trunk of every tree is a house of refuge.

As I write these lines in my leafy tent, a chipmunk comes in, foraging for his winter supplies. I have brought him cherry-pits and peach-pits and cracked wheat, from time to time, and now he calls on me several times a day. His den is in the orchard but a few yards from me, and I enjoy having him for so

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near a neighbor. He has at last become so familiar that he climbs to my lap, then to the table, then to my shoulder and head, looking for the kernels of popcorn that he is convinced have some perennial source of supply near me or about me. He clears up every kernel, and then on his return, in a few minutes, there they are again! I might think him a good deal puzzled by the prompt renewal of the supply if I were to read my own thoughts into his little nod-dle, but I see he is only eager to gather his harvest while it is plentiful and so near at hand. No, he is not influenced even by that consideration; he does not consider at all, in fact, but just goes for the corn in nervous eagerness and haste. Yet, if he does not reflect, he certainly has a wisdom and foresight of his own. This morning I mixed kernels of fresh-cut green corn with a handful of the dry, hard popcorn upon the floor. At first he began to eat the soft sweet corn, but, finding the small, dry kernels of the popcorn, he at once began to stuff his cheek pockets with them, and when they were full he hastened off to his den. Back he came in about three minutes and he kept on doing this till the popcorn was all gone; then he proceeded to make his breakfast off the green corn. When this was exhausted, he began to strip some choke-cherries (which I had also placed among the corn) of their skins and pulp, and to fill his pockets with the pits, thus carrying no perishable food to his den. He acted exactly as if he knew

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green corn and the choke cherries would his underground retreat, and that the hard, I, and the cherry-pits, would keep. He did but not as you and I know it, by experience, knew it, as all the wild creatures know how in the world, by the wisdom that pervades and is much older than we or they are.

chipmunk knows corn, cherry-pits, buck-eech-nuts, apple-seeds, and probably several odds, at sight; but peach-pits, hickory nuts, zeet corn, he at first passed by, and peach could not tempt him to touch at all. He was indifferent to the rice, but, on nibbling at it ing it toothsome, he began to fill his pockets

Amid the rice I scattered puffed wheat, repeatedly took up and chipped into, at probably by the odor, but, finding it hollow, st very spongy and unsubstantial in its in-ic quickly dropped it. It was not solid to get into his winter stores. After I had a few hickory-nuts he became very eager, and it was amusing to see him, as he sat on e, struggle to force the larger ones into his supplementing the contractile power of his muscles with his paws. When he failed to me, he would take it in his teeth and make Yered him some peach pits also, but he only one of them up on the stone wall and han-while, then looked it over and left it. But

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after I had cracked a few of them and had thus given him a taste of what was in them, he began to carry them to his den.

It is interesting to see how well these wild creatures are groomed — every hair in its place and shining as if it had just been polished. The tail of my chipmunk is simply perfect — not a hair missing or soiled or worn. In fact, the whole animal looks as new and fresh as a coin just minted, or a flower just opened. His underground habits leave no mark or stain upon him, and his daily labors do not ruffle a hair. This is true of nearly all the wild creatures. Domestication changes all this; domestic animals become dirty and unkempt. The half-tame gray squirrels in the parks have little of the wild grace and beauty of the squirrels in the woods. Especially do their tails deteriorate, and their sylvan airiness and delicacy disappear.

The whole character of the squirrel culminates and finds expression in its tail — all its nervous restlessness and wild beauty, all its jauntiness, archness, and suspicion, and every change of emotion, seem to ripple out along this appendage.

How furtive and nervous my chipmunk is, rushing about by little jerks incessantly, not stopping for anything! His bright, unwinking eyes, his palpitating body, his sudden spasmodic movements, his eagerness, his industry, his sleekness and cleanliness — what a picture he makes! Apparently he

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does not know me from a stump or a clothes-horse. His cold paws on my warm hand, on my arm, or on my head give him no hint of danger; no odors from my body, or look from my eyes, disturb him; the sound of my voice does not alarm him; but any movement on my part, and he is off. It is *moving* things — cats, weasels, hawks, foxes — that mean danger to him. In the little circuit of his life gathering his winter stores and his daily subsistence, spinning along the fences, threading the woods and bushes, his eye and his ear are evidently his main dependence; odors and still objects concern him little, but moving things very much. I once saw a chipmunk rush to his den in the side of a bank with great precipitation, and in a moment, like a flash, a shrike darted down and hovered over the entrance.

I can talk to my chipmunk in low, slow tones and he heeds me not, but any unusual sound outside the camp, and he is alertness itself. One day when he was on my table a crow flew over and called sharply and loudly; the squirrel sat up and took notice instantly; with his paws upon his breast he listened and looked intently for a few seconds, and then resumed his foraging. At another time the sharp call of a red squirrel in a tree near by made him still more nervous. With one raised paw he looked and listened for two or three minutes. The red squirrel hazes him on all occasions, and, I think, often robs him of his stores.

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No doubt the chipmunk has many narrow escapes from hawks. A hunter told me recently of a hawk-and-chipmunk incident that he had witnessed the day before in the woods on the mountain. He was standing still listening to the baying of his hound on the trail of a fox. Suddenly there was a rush and clatter of wings in the maple-trees near him, and he saw a large hawk in pursuit of a chipmunk coming down, close to the trunk of a tree, like a thunderbolt. As the hawk struck the ground, the hunter shot him dead. He had the squirrel in his claw as in a trap, and the hunter had to pry the talon open to free the victim, which was alive and able to run away. From the description I guessed the hawk to be a goshawk. What the chipmunk was doing up that tree is a mystery to me, since he seldom ventures far from the ground; but the truth of the incident is unquestioned.

When the chipmunk is in the open, the sense of danger is never absent from him. He is always on the alert. In his excursions along the fences to collect wild buckwheat, wild cherries, and various grains, he is watchfulness itself. In every trip to his den with his supplies, his manner is like that of the baseball-player in running the bases — he makes a dash from my study, leaping high over the grass and weeds, to an apple-tree ten yards away; here he pauses a few seconds and nervously surveys his course ahead; then he makes another sprint to a

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second apple-tree, and pauses as before, quickly glancing round; then in a few leaps he is at home, and in his den. Returning, he usually pursues the same course. He leaves no trail, and is never off his guard. No baseball runner was ever more watchful. Apparently while in the open he does not draw one breath free from a keen sense of danger. I have tempted him to search my coat pockets for the nuts or cherry-pits that I have placed there, and, when he does so, he seems to appreciate at what a disadvantage his enemy might find him — his eyes are for the moment covered, his rear is exposed, his whole situation is very insecure; hence he seizes a nut and reverses his position in a twinkling; his body palpitates; his eyes bulge; then he dives in again and seizes another nut as before, acting as if he thought each moment might be his last. When he goes into the tin cocoa-box for the cherry-pits, he does it with the hurry of fear; his eyes are above the rim every second or two; he does not stop to clean the pits as he does when on my table, but scoops them up with the greatest precipitation, as if he feared I might clap on the lid at any moment and make him prisoner. In all the hundred and one trips he has made from my camp to his den he has not for one moment forgotten himself; he runs all the bases with the same alertness and precaution. Coming back, he emerges from his hole, sits up, washes his face, then looks swiftly about, and is off for the base of supplies.



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One day I went by a roundabout course and stood three paces from his hole. In the mean time he had loaded up, and he came running over the course in his usual style, but before he left the second base he saw me, or an apparition that was not there before, and became very nervous. He jumped about; he sat up on his haunches and looked; crouched by a woodchuck's hole and eyed me, his cheeks protruding; changed his attitude a dozen times; then, as the apparition changed not, he started and came one third of the way; then his heart failed him and he rushed back. More posing and scrutinizing, when he made a second dash that brought him two thirds of the way; then his fears overcame him again, and he again rushed to cover. Repeating his former behavior for a few moments, he made a third dash and reached the home base in safety. How carefully he seems to carry his tail on entering his hole, so as not to let it touch the sides! He is out again in less than a minute, and, erect upon his haunches, looks me squarely in the eye. He is greatly agitated; he has not had that experience before. What does it mean? Erect on his hind legs, he stands almost motionless and eyes me. I stand motionless, too, with a half-eaten apple in my hand. I wink and breathe; so does he. For ten minutes we confront each other in this fashion, then he turns his back upon me and drops down. He looks toward the camp; he remembers the nuts and corn awaiting

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him there; he stirs uneasily; he changes his position; he looks at my motionless figure again, then toward the source of supplies, and is off, leaving me at his threshold. In two minutes he is back again with protruding pockets, and now makes the home run without a pause. He emerges again from his den, washes his face three times, his mouth first, then his nose and cheeks, then is off for another load. I return to my chair and soon he is again on my lap and table, or sitting in the hollow of my hand, loading up as before. The apparition in the chair has no terrors for him.

I would not say that he is burdened with a conscious sense of danger; rather is his fear instinctive and unconscious. It is in his blood—born with him and a part of his life. His race has been the prey of various animals and birds for untold ages, and it has survived by reason of an instinctive watchfulness that has been pushed to the highest degree of development. He is on the lookout for danger as constantly as he is on the lookout for food, and he takes no more thought about the one than about the other. His life is keyed to the fear pitch all the time. His heart beats as fast as the ticking of a watch, and all his movements are as abrupt and spasmodic as if they were born of alarm. His behavior is an excellent illustration of the unconscious fear that pervades a large part of the animal kingdom.

All creatures that are preyed upon by others lead

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this life of fear. I don't know that the crow is ever preyed upon by any other creature, so he apparently has a pretty good time. He is social and noisy and in the picnicking mood all the day long. Hawks apparently are afraid of man only. Hence their lives must be comparatively free from harassing fear. Even fish in the streams are not exempt from fear. They are preyed upon by large fish, and by minks and otters, and by the fish hawk. If the weasel has a natural enemy, I don't know what it is. He is the boldest of the bold. He might be captured by a hawk or an eagle, but such occurrences are probably very rare, as a weasel can dodge almost anything but a gun.

Of all our wild creatures the rabbit has the most enemies; weasels, minks, foxes, wildcats, and owls are hovering about poor Bunnie at all times. No wonder she never closes her eyes, even in sleep. To compensate in a measure for all this, nature has made her very fleet of foot and very prolific, so that the race of rabbits is in full tide, notwithstanding its many enemies.

Such animals as the skunk and the porcupine show little fear, because their natural enemies, if they have any, would go by on the other side. There is evidence that the skunk is sometimes preyed upon by the fox and the eagle and the horned owl, and the porcupine by the lynx and the wolf, but these must be exceptional occurrences. The lion probably fears

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nothing but man. Little wonder that he looks calm and majestic and always at his ease! But I am getting away from my apple-trees.

The arch-enemy of the chipmunk is the small red weasel, and I wonder if it is to hide from him that he usually digs his den away from the fences and other cover, in clean open ground, leaving no clue whatever as to its whereabouts. He carries away all the soil, and either makes a pile of it some feet away, or else hides it completely. The den of my little neighbor is in the open grassy space between the rows of apple-trees, thirty or more yards from either fence. All that is visible of it is a small round hole in the ground nearly concealed by the overhanging grass. I had to watch him in order to find it.

His chamber is about three feet below the surface of the ground, and has but one entrance, through a long crooked passage eight or ten feet long. If his arch-enemy were to find it, there would be no escape. There is no back door, and there are no secret passages. Probably many a tragedy is enacted in those little earth-chambers. The weasel himself fears nothing; he is the incarnation of bloodthirstiness, and his victims seem so horrified at the discovery that he is pursuing them that they become paralyzed. Even the fleet-footed rabbit in the open woods or fields falls an easy prey.

One day last summer as I sat at the table in my hay-barn study, there boldly entered through the

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open door this arch-enemy of our small rodents — brown of back and white of belly. He rushed in as if on very hurrying business, and all my efforts to detain him, by squeaking like a mouse, and chirping like a bird, proved unavailing. He thrust out his impudent snake-like head and neck from an opening in the wall, and fixed his intense, beady eyes upon me for a moment, and was gone. I feared he was on the trail of the chipmunk that had just carried away the cherry-pits I had placed for him on a stone near by; but the little rodent appeared a half-hour later, as sleek as ever, but with a touch of something suspicious and anxious in his manner, as if he had at least had tidings that his deadly enemy was in the neighborhood.

After I had cracked some hickory-nuts for my little friend this morning, and he had got a taste of the sweet morsel inside, he quickly began to stuff the whole nuts into his pockets and carry them to his storehouse. It was amusing to see him struggle with the larger nuts, first moistening them with his tongue, to force them into those secret and apparently inadequate pockets. The smooth, trim cheeks would suddenly assume the appearance of enormous wens, extending well down on the sides of the neck. The pouches are not merely passive receptacles; they evidently possess some power of muscular action, like the throat muscles, which enables them to force the grain and nuts along their whole course.

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As the little squirrel picks the corn from the floor you can see the pouches swell, first on the one side, then on the other. He seems to pick up the kernels and swallow them. What part the tongue plays in the process, one cannot see. In forcing a whole or a half hickory-nut into them, the chipmunk uses his paws. The pouches are doubtless emptied by muscular movements similar to those by which they were filled — a self-acting piece of machinery, a pocket that can fill and empty itself.

I see my little hermit making frequent visits to my study in the morning before I am seated there, exploring the floor, the chair, the table, to see if the miracle of the corn manna has not again happened. He is anxious to be on hand as soon as it occurs. He is no discriminator of persons. One morning a woman friend took her seat in my chair with corn in her lap and under her arched hand on the table, and waited. Presently the little forager appeared and climbed to her lap, and pushed under her hand, as he had under mine. Another woman sat on the cot a few feet away, and the two conversed in low tones. The squirrel gave little heed to them, but any movement of their hands or feet startled him. One day I shifted my position from the table to near the cot, with my extended feet near the entrance. The squirrel was in the act of coming in when I made some slight movement. With that characteristic chipping of his, he retreated hast-

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ily to the first apple-tree twenty feet away, and, perched upon its leaning trunk, sounded his little alarm, "Chuck, chuck," for fifteen minutes or more. Apparently he had but just discovered me. After a time he came slyly back and resumed his foraging.

The activity of the chipmunk when he is out of his den is almost incessant. Like the honey-bee, he seems filled with a raging impulse to lay up his winter stores. When he finds an ever-renewed supply, as in my orchard camp, his eagerness and industry are delightful to see. The more nuts I place for him, the more eager he becomes, as most of us do when we strike a rich lead of the things we are in quest of. Will his greed carry him to the point of filling his den so full that there remains no room for himself in it? Will he let the god of plenty turn him out of doors? Last summer I had seen a chipmunk's hole filled up with choke-cherries to within three inches of the top. ("Naturally, being choke-cherries," says a friend, looking over my shoulder.)

From previous experience I calculated the capacity of his chamber to be not more than four or five quarts. One day I gave him all I thought he could manage, — enough, I fancied, to fill his chamber full, — two quarts of hickory-nuts and some corn. How he responded to the invitation! How he flew over the course from my den to his! He fairly panted. The day might prove too short for him, or some other chipmunk might discover the pile of

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treasures. Three, and often four, nuts at a time, went into his pockets. If one of them was too large to go in readily, he would take it between his teeth. He would first bite off the sharp point from the nut to keep it from pricking or irritating his pouches. I do not think he feared a puncture. I renewed the pile of nuts from time to time, and looked on with interest. The day was cloudy and wet, but he ran his express train all day. His feet soon became muddy, and it was amusing to see him wash his face with those soiled paws every time he emerged from his hole. It was striking to see how much like a machine he behaved, going through the same motions at the same points, as regularly as a clock. He disappeared into his hole each time with a peculiarly graceful movement which seemed to find expression in the sweep of his tail. It was to the eye what melodious sounds are to the ear, and contrasted strangely with the sudden impulsive movements of his usual behavior. When he emerged, the top of his head and eyes first appeared, then a moment's pause, then the head and neck arose, then the whole body shot up in the erect posture with the paws folded and hanging down on the white breast. The face-washing was the next move, first the mouth, then the nose and cheeks. Then, after a swift glance around, off he goes, with tail well up in the air, for another load.

As the day declined, and the pile of nuts was ever



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renewed, I thought I saw signs that he was either getting discouraged or else that his den was getting too full. At five o'clock he began to carry the nuts out from my camp and conceal them here and there under the leaves and dry grass. His manner seemed undecided. He did not return to his den again while I waited near it. After some delay I saw him go to the stone wall and follow it till he was lost from sight under the hill. I concluded that his greed had at last really turned him out of doors and that he had gone off to spend the night with a neighbor. But my inference was wrong. The next day he was back again, carrying away a fresh supply of nuts as eagerly as ever. Two more quarts disappeared before night. The next day was rainy, and though other chipmunks were hurrying about, my little miser rested from his labors. A day later a fresh supply of nuts arrived — two quarts of chestnuts and one of hickory-nuts, and the greed of the little squirrel rose to the occasion. He made his trips as frequently as ever.

My enforced absence for a few days prevented me from witnessing all that happened, but a friend took notes for me. He tried to fool the chipmunk with a light-colored marble placed among the nuts. The squirrel picked it up, but quickly dropped it. Watching his opportunity, my friend rubbed the marble with the meat of a hickory-nut. The chipmunk smelled it; then put it in his pocket; then

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took it out, held it in his paws a moment and looked at it, and returned it to his pocket. Three times he did this before rejecting it. Evidently his sense of taste discredited his sense of smell.

On my return at the end of the week, the enthusiasm of the chipmunk had greatly abated. He was seldom out of his den. A nut or two placed at its entrance disappeared, but he visited me no more in my camp. Other chipmunks were active on all sides, but his solicitude about the winter had passed, or rather his hoarding instinct had been sated. His cellar was full. The rumor that right here was a land of plenty seemed to have gone abroad upon the air, and other chipmunks appeared upon the scene. Red squirrels and gray squirrels came, but we wasted no nuts upon them. A female chipmunk that came and occupied an old den at my doorstep was encouraged, however. She soon became as familiar as my first acquaintance, climbing to my table, taking nuts from my hand, and nipping my fingers spitefully when I held on to the nuts. Her behavior was as nearly like that of the other as two peas are alike. I gave her a fair supply of winter stores, but did not put her greed to the test.

So far as I have observed, the two sexes do not winter together, and there seems to be no sort of *camaraderie* between them. One day, earlier in this history, I saw my male neighbor chase a smaller chipmunk, which I have little doubt was this female,

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out of the camp and off into the stone wall, with great spitefulness. All-the-year-round love among the wild creatures is very rare, if it occurs at all. Love is seasonal and brief among most of them. My little recluse has ample supplies for quite a family, but I am certain he will spend the winter alone there in the darkness of his subterranean dwelling. He must have at least a peck of nuts that we gave him, besides all the supplies that he carried in from his foraging about the orchard and the fields earlier in the season. The temptation to dig down and uncover his treasures is very great, but my curiosity might lead to his undoing, at least to his serious discomfort, so I shall forbear, resting content in the thought that at least one fellow mortal has got all that his heart desires.

As our lives have touched here at my writing-table, each working out his life-problems, I have thought of what a gulf divides my little friend and me; yet he is as earnestly solving his problems as I am mine; though, of course, he does not worry over them, or take thought of them, as I do. I cannot even say that something not himself takes thought for him; there is no thought in the matter; there is what we have to call impulse, instinct, inherited habit, and the like, though these are only terms for mysteries. He, too, shares in this wonderful something we call life. The evolutionary struggle and unfolding was for him as well as for me. He, too, is

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a tiny bubble on the vast current of animate nature, whose beginning is beyond our ken in the dim past, and whose ending is equally beyond our ken in the dim future. He goes his pretty ways, gathers his precarious harvest, has his adventures, his hair-breadth escapes, his summer activity, his autumn plenty, his winter solitude and gloom, and his spring awakening and gladness. He has made himself a home here in the old orchard; he knows how deep to go into the ground to get beyond the frost-line; he is a pensioner upon the great bounty upon which we all draw, and probably lives up to the standard of the chipmunk life more nearly than most of us live up to the best standards of human life. May he so continue to live, and may we yet meet for many summers under the apple-boughs.

### PART II

When the spring came I was seized with a curiosity to know how much of his stores my little friend had disposed of, and which of his various assortment of nuts and grain had proved his favorites. To settle these points there was only one course to pursue: we must dig him out. So one April day we proceeded to do so. We at once discovered a new hole or entrance, only a few inches from the other, and apparently more in use than it was. We found his chamber about three feet below the surface with its usual nest of dry leaves and grass, and a few

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shells of hickory-nuts and cherry-pits, but, dig as we would, we could not find any recess or granary large enough to hold the peck or more of nuts that I had seen him carry in. We searched carefully for side chambers into which he might have stored the surplus of his unexpected harvest, but we found none. He would not have prepared in advance for such a contingency, as he could have had no hint of the bounty which a designing and near-by Providence was to bestow upon him.

The shells we found accounted for only a small fraction of those with which we had supplied him. Not a chestnut or a peach-pit or a hickory-nut did we find, nor any corn, nor wild seeds of any sort. I was much puzzled, and am still, as to just what had happened. The chipmunk either had been plundered by his neighbors, or else had freely distributed his supplies among them. What did the new hole signify? The old one was ample, and led to the same chamber. We did not find the chipmunk in his den, nor any convincing evidence that he had recently been there. Although I spent the following summer in the same bush camp, I am not certain that I ever saw my little neighbor that season. But the next following season, he or another was again my neighbor under the apple-trees, and disclosed to me a refreshing bit of natural history — that of a chipmunk digging his hole. He came and dug it in broad daylight within a few yards of my bush camp under

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the apple-trees, and gave me daily opportunities to watch the proceedings.

I have never known any one who has been so fortunate in this respect, nor have I ever seen in print any account of the little rodent's proceedings on such an occasion. For several years I have been an observer and an investigator of their little mounds of freshly dug earth along the margin of the highways or the woody borders of the fields, but until now have never caught one of the little miners at work. I had fancied that the digging was done at night, and that the earth was carried out to the dumping-place in the cheek pouches. But such is not the case. My little neighbor worked by day, and his cheek pockets were never used in transporting the earth from his hole to the dumping-place. I had often found the pile of fresh earth two or three yards from the hole out of which it came, with never a grain of soil littering the grass between the two, and no sign of a trail. I had also been fairly bewildered by finding stones in the pile of fresh soil so large that they could not be forced back into the hole out of which I was sure they had come. On three occasions I had found such freshly dug stones, and they were all too big for the opening that led to the chipmunk's den. By what magic had he got them out? From what I had seen one November, after the earth had been frozen and then thawed once or twice, I concluded that the little engineer had made a niche in

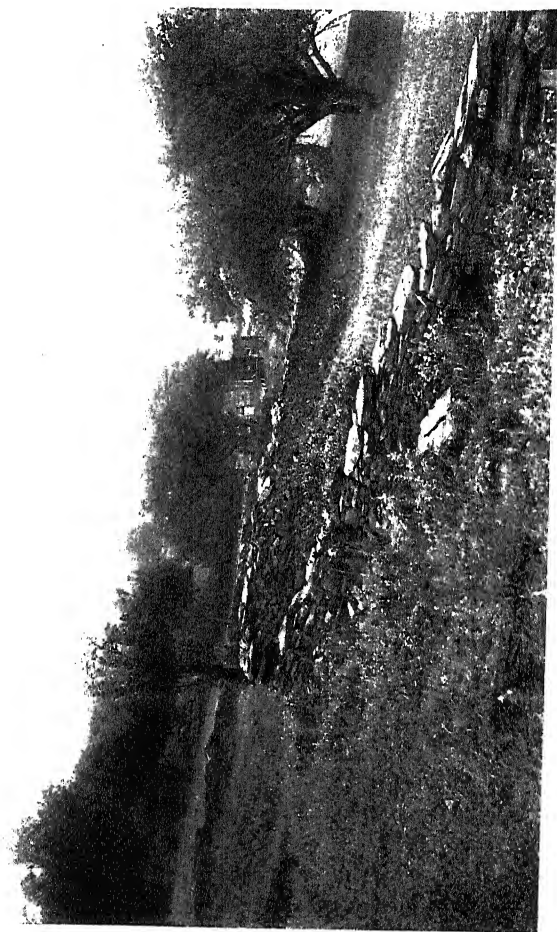
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the side of his hole just deep enough to make room for the passage of these broad, flat stones, and then had packed it full of earth again. In one case where a red squirrel had apparently been trying to force an entrance, such a niche was disclosed, as if the softer earth there had dropped out. Yet, as I had found other holes the rims of which had evidently never been tampered with, and the dump of which held one or more stones larger than its diameter, I was hopelessly puzzled. I had found still other holes that had no dump at all -- not a grain of fresh earth anywhere in their neighborhood. There is one by the roadside in front of Woodchuck Lodge now, eight feet from the stone fence, into which the chipmunk is daily carrying his winter stores, but which has not the slightest vestige of an earth-mound anywhere in its vicinity. If the squirrel ever carried the dirt away in his cheek pockets, I might conclude that he had scattered it along the roadway. This mystery of the holes that have no visible dumping-place I have not yet cleared up. Were there a woodchuck-hole near any of them I might think that the loosened soil had been shot into that. As the problem stands with me now, it is an insoluble mystery. A friend suggests that, like the Irishman, he probably digs another hole to put the earth in, which reminds me of an old story about two countrymen who tried to "stump" each other with questions, it being stipulated that no question

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should be asked that could not be answered by the propounder.

"How is it," said one, "that a chipmunk digs a hole without throwing out any dirt?"

"You can't answer that yourself," said the other.

"I can; he begins at the other end of the hole," replied the first.

"How does he get to the other end?" asked the second.

"You must n't ask any question that you can't answer yourself."

It is certainly true that in such cases the chipmunk did begin at the other end of his hole, but that end must be somewhere on the surface of the ground. In all cases, whether there is a pile of earth or not, the hole is cut up through the turf from beneath, and hence all the soil must have been removed back along the tunnel and out at the entrance. We often see the same thing in the procedure of the woodchucks — the large pile of earth at the mouth of the main entrance and another hole a few yards away which has been cut up through the turf from below. The woodchuck makes no effort at concealment as does the chipmunk, but apparently aims only at convenience and safety. But how the squirrel can dispose of a bushel of soil and leave no trace is a problem. The mystery of the large stones was soon made clear; they did not come out of the neat, round hole in the turf through which the squirrel enters or

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leaves his finished den, but out of the larger work-hole through which the soil was removed, and which is finally stopped up and obliterated.

I happened to discover my chipmunk probably the second day after he had begun to dig. Some people were calling on me at my bush camp when, as they turned to go, one of them said, "See that chipmunk!" I looked and saw him sitting up amid a little fresh earth, washing his face. His face certainly needed washing; it was so soiled it looked comical. Presently I investigated the spot and found a rude hole a few inches deep, with the loosened earth in front of it. "Evidently a greenhorn," I said; "a pretty dooryard he will have by the time he finishes, with a hole big enough to admit a red squirrel!"

Next morning there was more fresh earth in front of the hole; indeed, the grass was full of it a foot or more away, and a dump-pile had just been begun. From the hole to this pile there was a deep, wide groove in the loose soil, which I soon saw was made by the squirrel shoving the loosened earth from the hole to the dump, using his nose as a shovel. Day after day, for nearly a week thereafter, I saw him at work, digging and pushing the soil up to the mouth of his hole, and then pushing it along this groove or channel to the dump-heap. His movements were so quick and energetic that, at the final stroke, the soil, a half-teaspoonful or more, would shoot from his

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nose four or five inches. As he turned back along his roadway he would rapidly paw the earth behind him, and then, before entering his hole, would take a quick look all around. He was never for a moment off guard; the sense of danger was ever present with him. As he entered his hole, a succession of quick jets of earth, forming little parabolas in the air, would shoot up behind him. Then all would be still for from three to four minutes, when he would again emerge, shoving the soil before him and continuing to butt it, quickly glancing right and left the while, till he shot it upon his dump.

This was his invariable procedure. Every motion was repeated like clockwork, the forward shoving, the retreating pawing, and the flying spray of earth as he disappeared in his hole.

I fancied him there underground loosening the soil with his paws, for two or three minutes, then either kicking it up toward the exit or else shoving it in front of him. When at work he was intensely preoccupied; only one other feeling seemed to possess him — that of impending danger. One day while he was mining beneath the surface, I sprinkled some corn and pumpkin-seeds along his highway and in the mouth of his hole, but when he came to the surface with his burden of soil he heeded them not; he shoveled or pawed them along with his soil, and buried them beneath it. The incident reminded me of the hound I once intercepted, hot on the trail

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of a fox; I offered her my lunch and, holding her, even put it in her mouth, but she threw it disdainfully from her, and rushed on along that steaming trail. She had but one thought or sense at that moment: she was beside herself about that fox, and her attention could not be diverted from it. My chipmunk when at work was alike obsessed; he knew nothing but his work and the danger from his enemies.

Day by day the mound of fresh earth grew and spread back more and more toward the hole out of which it came, till it seemed about to cover it. At times the squirrel either worked at night or else very early in the morning before I was on the scene. But later he was not on his job till past mid-forenoon. For two or three days he promptly appeared at eleven o'clock. He would come leaping over the grass from some point behind my camp and quickly resume his excavating. Once he found some fresh peach-pits upon his mound; these arrested his attention; he seized them one by one, nibbled off the bits of pulp that were still clinging to them, then dropped them and took up his task. He usually knocked off work by or before two in the afternoon.

Evidently he has no partner and will spend the winter in his subterranean retreat alone. I think this is an established chipmunk custom, rendered necessary, it may be, by the scant supply of air in such close quarters, three feet underground, and

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maybe under three or more feet of snow in addition. At any rate, the chipmunk, male or female, is a hermit, and there is no coöperation or true sociability among them. They are wonderfully provident and industrious, beginning to store up their winter food in midsummer, or as early as the farmer does his. When the nut-crop fails them, as it has this present season, they scour about the neighborhood, gathering all sorts of wild seeds and grains, and wild-cherry pits, working almost as steadily as do the ants and the bees. In the mean time they feed on insects and berries and various green things, but only cured grains and nuts go into their winter stores.

The wild creatures rarely make an economic blunder. We are told on excellent authority that the coney, or least hare, in the Rocky Mountains spreads its newly cut grass and other green food on the rocks in the sun, and dries it as carefully as the farmer dries his hay before storing it up for winter use. I think we are safe in saying that it is not the coney's individual wisdom or experience that prompts him to do this, but the wisdom of something much older than he is. It is the wisdom of nature, inherent and active as instinct.

One day, when I paused before my little neighbor's mound of earth, I saw that the hole was nearly stopped up, and, while I was looking, the closure was completed from within. Loose earth



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was being shoved up from below and pressed into the opening; the movement of the soil could be seen. It flashed upon me at once that here was the key to the secret that had so puzzled me — he would obliterate that ugly and irregular work-hole and the littered dooryard, bury them beneath his mound of earth, and, working from within, would make a new and neater outlet somewhere through the turf near by. He was probably carrying out that scheme at that moment, and was disposing of the loose earth in the way I had observed. The next day the mound of earth had been extended over the place where the hole had been, and the chipmunk was still active beneath it, pushing up fresh earth like a ground-mole. At intervals of a few moments, the fresh soil would slowly heave or boil up, as it does when a hidden crayfish or mole is at work. Twice while I looked the head of the digger came through the thin screen of earth, as if by accident; he winked and blinked as the dirt slid off his head and over his eyes, then ducked beneath it and proceeded with his work. I began to look in the turf around me for the new entrance which I knew would soon be, if it were not already, made. I did not that day find it, but the next morning there it was, not more than four inches from the edge of the dump-heap — a little round shadow under the grass-blades and wild-strawberry leaves, about half the size of the work-hole, with no stain of the soil about

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it, and having such a look of neatness and privacy as could not have been given to it if it had been made from without. How furtive and secretive it looked! Still the little miner kept at work, still the fresh earth boiled up above the old entrance. He is excavating his chamber, I thought; he requires a den or vault down there, of several quarts' capacity, in which to build his nest and store his food. Whether or not he was then excavating his chamber and storeroom, the next day I found two more new holes in the turf, one a foot or more from the first one, and the other three or more feet away in another direction — both of them having the same shy, elusive character. Why all these extra holes? I asked. I have never before known of a chipmunk's den with so many back or front doors. Are they only for means of escape if robbers or murderers gain an entrance? If so, they afford another proof of the provident cunning of our little striped friend. It happened in this case that the squirrel brought to the surface no stones too large for the new entrance, but his work-hole was so large and irregular that he might easily have done so.

My chipmunk was engaged for nearly three weeks in his excavations. I knew when he had finished by his boldly coming into my camp one morning, a minute or two after he had seen me enter it. Looking intently up in my face for a few seconds, he proceeded to stuff his mouth with the dry leaves most

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to his liking that my bushy walls afforded. He did not try to pack the leaves in his cheek pouches, but crammed four or five into his mouth and then made off to his den. He was furnishing his house. Many mouthfuls of dry leaves and fine grass doubtless went to the furnishing, though I chanced to witness only this one. His bedroom is his granary; his winter stores are packed all around and under his nest. Some of his neighbors have been carrying in their supplies since July, just what I could not find out; probably wild seeds of some kind. As there are no beech-nuts this season, and no buckwheat or oat-fields near by, I am wondering what my little neighbor is counting on to carry him over the winter. He may have some source of supply that I know not of. I gave him cherry-pits and plum-pits from time to time before his den was finished, and he seemed to have some place to store them. I hope he is not counting too confidently upon the continuance of this bounty.

In my walks I have many times come across chipmunk-holes with a pile of earth before them, and a general look of carelessness and disorder all about, and I have said, "That squirrel is a bungler; he is not equal to his task." The present season I have seen three such holes while walking less than a mile along the highway. They appeared to have been abandoned. Now I know they were only beginnings, and that had the owners finished their man-

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sions, they would have presented a far different appearance. That ugly work-hole, with its belittered dooryard, would have been completely covered up, and the real entrance deftly concealed.

It is highly improbable that every individual chipmunk has a way peculiar to himself, as we humans so often have. Their dens and modes of procedure in digging them are as near alike as two peas, or as two chipmunks themselves. Yet there remains the mystery of an occasional hole without any pile of earth anywhere in sight. I find several such each season, and I can offer no plausible explanation of them.

I have found two weasels' dens on the margin of a muck swamp in the woods that presented the same insoluble problem — what had become of the bushel or more of earth that must have been brought to the surface? Both the weasel and the chipmunk have several galleries and one or more large chambers or dining-halls, and how each manages to hide or obliterate all the loose soil that must have been removed is a question which has long puzzled me. If we had an American Fabre, or a man who would give himself up to the study of the life-histories of our rodents, with the same patience and enthusiasm that the wonderful Frenchman has had for the life-histories of the insects, he would doubtless soon solve the mystery for me.

I used to think that the chipmunk carried away the soil in his cheek pockets, and have so stated in

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one of my books, but I am now very certain that he does not — only his food-stores are thus carried. In the present case I measured the excavated earth and found it a plump bushel.

From the point of view of modern scientific philosophy, — namely, that the needs of the organism beget the organ, and a change of use modifies it, — it is interesting to note to what novel use the chipmunk puts his nose in digging his den, apparently without changing or impairing it as an organ of smell. If he has been doing this through biological ages, using it as a kind of scoop and pusher, is it not remarkable that it has not undergone some modification that would make it better suited for these purposes? Note the shovel-footed mole, with his huge, muscular fore paws with which he forces his way through the soil and heaves it up to the surface, or the pig with his nose so well adapted to rooting. The nose of the chipmunk does not perceptibly differ from that of the other squirrels, which do no underground work. Are we not forced to the conclusion that the life-habits of the chipmunk have been much changed since the country has been so largely denuded of its forests, thus forcing him to become a dweller in the open? In the primitive woods, with the thick coating of leaves and of snow upon the ground, he would not have needed to penetrate the earth so deeply. The wood frogs go barely a few inches under the leaves and leaf-mould, where

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they remain unfrozen all winter. Our beech-woods to-day, when there is a crop of nuts, fairly swarm with chipmunks, and all of them have holes, but rarely is there any sign of freshly dug earth.

None of our wild creatures have as yet become much modified, either in form or color, as a result of the change in their environment by the disappearance of the forests. They have changed in habits, but the habits have not as yet set their stamp upon the organism. Is it not probable that if the chipmunk goes on scooping and packing soil with his nose for long ages, his anatomy will in time become better adapted to this new use?

I fancy that in time the woodchuck, which from a wood-dweller has now so commonly become a denizen of the fields, will change in color, at least. How his form now stands out on the smooth surface of the green fields! His enemies can see him from afar. Is this the reason that while feeding he momentarily rises up on his hind legs and takes an observation? He is instinctively uneasy under his give away color. As a wood dweller his colors were assimilative and therefore protective, but now they advertise him to every enemy in the landscape. In the course of ages he should become a much lighter brown or gray—that is, if our theories as to assimilative coloration are well founded. But there is no doubt but that use and wont as well as environment do in time leave their stamp upon every living creature.

## II

### THE FRIENDLY ROCKS

I FIND there is enough of the troglodyte in most persons to make them love the rocks and the caves and ledges that the air and the rains have carved out of them.

The rocks are not so close akin to us as the soil; they are one more remove from us; but they lie back of all, and are the final source of all. I do not suppose they attract us on this account, but on quite other grounds. Rocks do not recommend the land to the tiller of the soil, but they recommend it to those who reap a harvest of another sort — the artist, the poet, the walker, the student and lover of all primitive open-air things.

Time, geologic time, looks out at us from the rocks as from no other objects in the landscape. Geologic time! How the striking of the great clock, whose hours are millions of years, reverberates out of the abyss of the past! Mountains fall, and the foundations of the earth shift, as it beats out the moments of terrestrial history. Rocks have literally come down to us from a foreworld. The youth of the earth is in the soil and in the trees and verdure that springs from it; its age is in the rocks; in the

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great stone book of the geologic strata its history is written. Even if we do not know our geology, there is something in the face of a cliff and in the look of a granite boulder that gives us pause and draws us thitherward in our walk. We linger beneath the cliff, or muse and dream amid its ruins as amid the ruins of some earth temple; we pause beside the huge boulder, or rest upon it and survey the landscape from its coign of vantage; we lay our hand upon it as upon some curious relic from a world that we know not of. The elemental, the primordial, the silence of ages, the hush and repose of a measureless antiquity look out upon us from the face of the rocks. "The menacing might of the globe" is in the cliffs and the crags; its ease and contentment are in the slumbering boulders. One might have a worse fate than to have his lot cast in a rockless country — a treeless country would be still worse; but how the emigrant from New England or New York to the prairie States or to the cotton States, must miss his paternal rocks and ledges! A prairie farm has no past, no history looks out of it, no battle of the elemental forces has been fought there, and only a very tame, bloodless battle of the human forces.

A landscape without rocks lacks something. Without the outcropping ledge, the faces of the hills lack eyebrows; without a drift boulder here and there, the fields lack the rugged elemental touch. Next to the trees, rocks are points of interest in the



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landscape. Slumbering here and there upon the turf, they enhance the sense of repose. How expressionless and uninteresting the landscape in one of the prairie States, or in one of the Southern States, contrasted with a New England or a New York farm! The grazing or ruminating cattle add a picturesque feature, but the gray granite boulders have been lying there chewing their stony cud vastly longer. How meditative and contented they look, dreaming the centuries away!

The rocks have a history; gray and weather-worn, they are veterans of many battles; they have most of them marched in the ranks of vast stone brigades during the ice age; they have been torn from the hills, recruited from the mountain-tops, and marshaled on the plains and in the valleys; and now the elemental war is over, there they lie waging a gentle but incessant warfare with time, and slowly, oh, so slowly, yielding to its attacks! I say they lie there, but some of them are still in motion, creeping down the slopes, or out from the clay-banks, nudged and urged along by the frosts and the rains, and the sun. It is hard even for the rocks to keep still in this world of motion, but it takes the hour-hand of many years to mark their progress. What in my childhood we called "the old pennyroyal rock," because pennyroyal always grew beside it, has, in my time, crept out of the bank by the roadside three or four feet. When a rock, loosened from its ties in the hills,

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once becomes a wanderer, it is restless ever after, and stirs in its sleep. Heat and cold expand and contract it, and make it creep down an incline. Hitch your rock to a sunbeam, and come back in a hundred years, and see how much it has moved. I know a great platform of rock weighing hundreds of tons, and large enough to build a house upon, that has slid down the hill from the ledges above, and that is pushing a roll of turf before it as a boat pushes a wave, but stand there till you are gray, and you will see no motion; return in a century, and you will doubtless find that the great rock raft has progressed a few inches. What a sense of leisure such things give us hurrying mortals!

One of my favorite pastimes from boyhood up, when in my home country in the Catskills, has been to prowl about under the ledges of the dark gray shelving rocks that jut out from the sides of the hills and mountains, often forming a roof over one's head many feet in extent, and now and then sheltering a cool, sweet spring, and more often sheltering the exquisite moss-covered nest of the phoebe-bird. These ledges appealed to the wild and adventurous in the boy. The primitive cave-dweller in me, which is barely skin-deep in most boys, found something congenial there; the air smelled good; it seemed fresher and more primitive than the outside air; it was the breath of the rocks and of the everlasting hills; the home feeling which I had amid such scenes

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landscape. Slumbering here and there upon the turf, they enhance the sense of repose. How expressionless and uninteresting the landscape in one of the prairie States, or in one of the Southern States, contrasted with a New England or a New York farm! The grazing or ruminating cattle add a picturesque feature, but the gray granite boulders have been lying there chewing their stony cud vastly longer. How meditative and contented they look, dreaming the centuries away!

The rocks have a history; gray and weather-worn, they are veterans of many battles; they have most of them marched in the ranks of vast stone brigades during the ice age; they have been torn from the hills, recruited from the mountain-tops, and marshaled on the plains and in the valleys; and now the elemental war is over, there they lie waging a gentle but incessant warfare with time, and slowly, oh, so slowly, yielding to its attacks! I say they lie there, but some of them are still in motion, creeping down the slopes, or out from the clay-banks, nudged and urged along by the frosts and the rains, and the sun. It is hard even for the rocks to keep still in this world of motion, but it takes the hour-hand of many years to mark their progress. What in my childhood we called "the old pennyroyal rock," because pennyroyal always grew beside it, has, in my time, crept out of the bank by the roadside three or four feet. When a rock, loosened from its ties in the hills,

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doubtless dated back to the time when our rude forebears were cave-dwellers in very earnest. The little niches and miniature recesses in the rocks at the side were so pretty and suggestive, and would have been so useful to a real troglodyte. Of a hot summer Sunday one found the coolness of the heart of the hills in these rocky cells, and in winter one found the air tempered by warmth from the same source. To get down on one's hands and knees and creep through an opening in the rocks where bears and Indians have doubtless crept, or to kindle a fire where one fancies prehistoric fires have burned, or to eat black birch and wintergreens, or a lunch of wild strawberries and bread where Indians had probably often supped on roots or game — what more welcome to a boy than that?

As a man I love still to loiter about these open doors of the hills, playing the geologist and the naturalist, or half-playing them, and half-dreaming in the spirit of my youthful days. Phoebe-birds' nests may be found any day under these rocks, but on one of my recent visits to them I found an unusual nest on the face of the rocks such I had never before seen. At the first glance, from its mossy exterior, I took it for a phoebe's nest, but close inspection showed it to be a mouse's nest — the most delicate and artistic bit of mouse architecture I ever saw — a regular mouse palace; dome-shaped, covered with long moss that grew where the water had

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sued from the rocks a few yards away, and set upon a little shelf as if it had grown there. There was a hole on one side that led to the soft and warm interior, but when my forefinger called, the tiny aristocrat was not in. Whether he or she belonged to the tribe of the white-footed mouse, or to that of the jumping mouse, I could not tell. Was the device of the mossy exterior learned from the phœbe? Of course not; both had been to the same great school of Dame Nature.

Through the eyes of the geologist I see what the agents of erosion have done, how the tooth of time has eaten out the layers of the soft old red sandstone, and left the harder layers of the superimposed Catskill rock to project unsupported many feet. I see these soft red layers running through under the mountains from valley to valley, level as a floor, and lending themselves to the formation of the beautiful waterfalls that are found here and there in the out brooks of that region. At one such waterfall, a mile or more from the old schoolhouse, we used to go, when I was a boy, for our slate pencils, looking for the softer green streaks in the crumbling slaty sandstone, and trying them on our teeth to see whether or not they were likely to scratch our precious slates. In imagination I follow this slaty layer through under the mountains and see where it is cut off by other waterfalls that I know, ten, twenty, thirty miles away. At those falls the water usually

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makes a sheer leap the whole distance, — twenty, thirty, or fifty feet, as the case may be, — the harder rock at the top always holding out while the softer layers retreat beneath it, forming in this respect miniature Niagaras. When near one of these falls I seldom miss the opportunity to climb the side of the gorge under the overhanging rock and inspect its under surface, and feel it with my hand. The elements have here separated the leaves of the great stone book and one may read some of the history written there. When I pass my hand over the bottom side of the superincumbent rock, I know I am passing it over the contours, the little depressions and unevennesses of surface, of the mud of the old lake or inland sea bottom, upon which the material of the harder rock was laid down more than fifty millions of years ago. There are here and there little protuberances, the size of peas and beans, which probably mark where little gas bubbles were in the old mud bottom.

One thing that arrests attention in such a place is the abruptness of the change from one species of rock to another, as marked and sudden as a change in a piece of masonry from brick to stone, or from stone to iron. The two meet but do not mingle. Nature seems suddenly to have turned over a new leaf, and to have begun a new chapter in her great stone book. What happened? There is no evidence in this region of crustal disturbance since

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the original plateau out of which the mountains were carved was first lifted up in Palæozoic times, when the earth was in her teens. The indications are that on some quiet day the peaceful waters became suddenly charged with new material and the streams or rivers from some unknown land in the vicinity poured it into the old Devonian lakes where it hardened into rock. The changes indicated by these streaks of soft red sandstone suddenly alternating with the hard laminated Catskill formation, well up the mountain-sides, with a sharp dividing line between them, occurred many times during the Devonian Age. During one geologic day the earth-building forces brought one kind of material, and the next day material of quite another kind, and this alternation without any change of character seems to have kept up for millions of years. How curious, how interesting! Both from near-by land surfaces, and yet so different from each other! How difficult to form any mental picture of the condition of things in those remote geologic ages! It is as if one day it had snowed something like brick-dust to a depth of many feet, and the next day it had snowed a dark-gray dust of an entirely different character, and that this alternation of storms had kept up for ages. Long before we reach the tops of the mountains, or at about a thousand feet above the river valley, the red soft strata cease,



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and the hard dark, cross-bedded gray rock continues to the top.

In the higher peaks of the southern Catskills another kind of rock begins to appear before the summit is reached — a conglomerate. The storm of dark snow has turned to a storm of white hail. As you go up, you seem to be climbing into a shower of quartz pebbles. Presently you begin to see here and there a pebble embedded in the rocks; then, as you go on, you see more of them, and still more; it is like the first sprinkle of rain that precedes the shower, till, long before you reach the summit, the regular downpour begins, the rocks become solid masses of pebbles embedded in a gray hard matrix; there are many hundreds of feet of them. On the top the soil is mainly sand and coarse gravel from the disintegrated rock.

The streams at the foot of the mountains abound in fragments of this pudding-stone or conglomerate, and in the hard, liberated quartz pebbles. These pebbles were rolled on an ancient sea-beach incalculable ages ago, and now they are being rolled and worn again by the limpid waters of the Catskill trout-brooks. What varied fortune the whirligig of time brings to quartz pebbles as well as to men!

Of course the Catskills were under water when this conglomerate was laid down upon them. The coal age was near at hand, and a conglomerate akin to this of the tops of the Catskills underlies the coal

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measures. The Catskill plateau was lifted up before Carboniferous times began, so that there is no coal in this region. We should have to look overhead for it instead of underfoot. When the Catskill plateau rose above the waters, Pennsylvania and most of the continent to the west was under the sea, receiving additional deposits, thousands of feet thick in many places, and in due time supporting a vegetation that gave us our vast deposits of coal.

The geologic tornado that brought this hailstorm of quartz pebbles, so marked in the conglomerate that caps the highest Catskills, seems to have been a general storm over a large part of the northern hemisphere, as this conglomerate underlies the coal measures, both in this country and in Europe. It must have occurred in late Devonian or early Carboniferous times. On the top of Lookout Mountain, in Tennessee, I gathered a handful of pebbles that had weathered out of the Carboniferous sandstone that the ages have exposed on the summit.

An earlier storm of quartz pebbles occurred in Silurian times, which formed the Oneida conglomerate in central New York, and the Shawangunk range in southern New York. This latter range is a vast windrow made up of small pebbles varying in size from peas to large beans, cemented together by quartz sand. It is several hundred feet thick and runs southwest through Pennsylvania into Virginia, affording another proof of the abundance of quartz

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rock in those early geologic ages. Dana thinks this conglomerate gives us an idea of the seashore work of that period. Only on a seashore could the crushed material have been sorted and distributed in this way.

According to the published views of a natural philosopher on the Pacific Coast, this rain of rock material from the heavens is no myth. He believes that the earth in its early history was surrounded by a series of numerous concentric rings of floating cosmic matter, like the rings of Saturn, and that from time to time these rings collapsed and their material fell to earth helping to make up the vast series of stratified rocks. This theory certainly simplifies some of the problems of the geologist. My Catskills did not have to go down under the sea to get this coat of mail of quartz pebbles, or these alternate layers of red and gray sandstone, and the question of the abrupt ending and beginning of the different series is easily solved; as is also the larger question of where all the diverse material of our enormous system of stratified rock, reckoned by some geologists to be not less than twenty miles thick in North America, came from. In some parts of Scotland, the old red sandstone, according to Geikie, is twenty thousand feet thick. This explanation of the California theorist gives us all this material, and gives it in the original packages. I wish I could believe it true — and be thankful that there are no more rings to collapse!

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How one would like to know the history of this conglomerate that caps the higher Catskills! What stone-crusher reduced the quartz rock and sorted the fragments so evenly? The stone-crushing plant that turned out the material for most of the other rocks ground "exceeding fine," but in this instance they turned out a very coarse product, though a very uniform one. On the shores of some Palæozoic sea have these pebbles been rolled and worn. Only upon one sea-beach have I seen pebbles of this size in lieu of sand, and that was upon Dover beach, on the coast of England. Instead of the hissing of the sands when the breakers come in, there rises the sound of the multitudinous rattling of these myriads of pebbles. Some old Devonian seashore has sent up a like sound where these Catskill pebbles were washed by the waves.

The rock-crushing plants must have been very busy in the early geologic ages, and quartz rock must have been a drug in the market. We see no natural forces at work now reducing rocks to coarse gravel on any scale comparable to that which must have taken place in Silurian times when the Shawangunk rocks and the Oneida conglomerate were laid down. In any case, where were the quartz mountains from which they came, and where were the forces that ground them up? "From lands to the eastward," geologists think, but of such lands there are no traces now.

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On the Pacific Coast of southern California I saw a strip of country nearly a hundred miles long and from fifteen to twenty miles wide that was mainly made up of large quartz pebbles. The land was thrown into gentle hills and ridges which became higher as they approached the mountains. Near its inland margin I heard of a search for oil that had been made there, the drill going through nine hundred feet of pebbles and striking the granite rock — an unlikely place for oil. But think of the quartz mountains that must have been broken up and put through the mill of the Pacific to form all the vast banks of water-worn pebbles!

In South America Darwin saw hills and mountains of pure quartz. Not far from Buenos Ayres they formed tablelands or mesas, without cleavage or stratification. On the Falkland Islands he found the hills of quartz and the valleys filled with "streams of stone" — huge fragments of quartz rock varying in size from a few feet in diameter "to ten or even more than twenty times as much." Darwin thinks that these streams of quartz stones may have had their origin in streams of white lava that had flowed from many parts of the mountains into the valleys, and then, when solidified, were rent by some enormous convulsion into myriads of fragments. Some such titanic force of nature must have been the stone-crusher that converted vast hills of quartz into the fragments that make up the

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Shawangunk Mountains, the Oneida conglomerate, and the conglomerate on the tops of the Catskills.

In our Northern States there are two classes of rocks: the place rocks, and the wanderers, or drift boulders. The boulders are in some ways the more interesting; they have a story to tell which the place rock has not; they have drifted about upon a sea of change, slow and unwilling voyagers from the North many tens of thousands of years ago; now they lie here in the fields and on the hills, shipwrecked mariners, in some cases hundreds of miles from home. But usually they have been plucked from the neighboring ledges or mountains, and shoved or transported to where they now lie. In nearly all cases the sharp points and angles have been rubbed down, as with most travelers, and they lie about the fields like cattle ruminating upon the ground.

"The shadow of a great rock in a weary land" is pretty sure to be the shadow of a drift boulder. The rock about which, and on which, we played as children was doubtless a drift boulder; the rocks beneath which the woodchucks and the foxes burrow are drift boulders; the rock under the spreading maples where the picnickers eat their lunch is a drift boulder; the rock that makes the deep pool in the trout-stream of your boyhood is a drift boulder; the rocks which you helped your father pry up from the fields and haul to their place for the "rock bottom" of the stone wall, in the old days on the farm,

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were all drift boulders. How sod-bound many of them were, and how the old oxen used to settle into their bows with rigid muscles in pulling them from their beds! If you had looked on their under sides you would have seen how smoothed and worn most of them were. They had been hauled across the land by oxen of another kind long before yours were heard of.

The rocks that give the eyebrows to the faces of the hills are place rocks — the cropping-out of the original strata. The place rock gives the contour to the landscape; it forms the ledges and cliffs; it thrusts a huge rocky fist up through the turf here and there, or it exposes a broad smooth surface where you may see the grooves and scratches of the great ice sheet, tens of thousands of years old. The marks of the old ice-plane upon the rocks weather out very slowly. When they are covered with a few inches of soil they are as distinct as those we saw in Alaska under the edges of the retreating glaciers.

One day, on the crest of a hill above my Lodge on the home farm in the Catskills, I used my spade to remove five or six inches of soil from the upper layer of rock in order to prove to some doubting friends that a page of history was written here that they had never suspected. I quickly disclosed the lines and the grooves, nearly as sharp as if made but yesterday, and as straight as if drawn by a rule, running from northeast to southwest. Across the valley, a

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bird of a mile away, I uncovered other rock surfaces on the same level, that showed a continuation of the same lines. The great jack-plane had been moved across the valley and over the mountain-tops and had taken off rocky shavings of unknown thickness.

The drift boulders are not found beyond the southern limit of the great ice-sheet — an irregular line starting a little south of New York and running westward to the Rocky Mountains, but in southern California I saw huge granite boulders that looked singularly like New England drift boulders. They were over the hill called Rubidoux at Riverside. I overheard a tourist explaining to his companions how the old glaciers had brought them there, apparently ignorant of the fact that they were far beyond the southern limit of the old ice-sheet. It is quite evident that they were harder masses that had weathered out of the place rock and had slowly tumbled about and crept down the hill under the expansive power of the sun's rays. But I saw one drift boulder in southern California that was a puzzle; it was a water-worn mass of metamorphic rock, nearly as high as my head, at the end of a valley, several miles in among the hills, with no kindred rocks or boulders near it. It was evidently far from home, but what its means of transportation had been I could only conjecture.

Amid the flock of gray and brown boulders that



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dot my native fields, there is here and there a black sheep — a rough-coated rock much darker than the rest, which the farmers call firestone, mainly, I suppose, because it does not break or explode in the fire. It is a kind of conglomerate, probably what the geologists call breccia, made up of the consolidated smaller fragments of older crushed rocks. The material of which it is composed is of unequal hardness, so that it weathers very rough, presenting a surface deeply pitted and worm-eaten, which does not offer an inviting seat. These rocks wear a darker coat of moss and lichens than the others and seem like interlopers in the family of field boulders. But they really belong here; they have weathered out of the place strata. Here and there one may find their dark worm-eaten fronts in the outcropping ledges. They were probably formed of the coarser material — a miscellaneous assortment of small thin water-worn fragments of rocks and mud and coarse sand — that accumulated about the mouths of the streams and rivers which flowed into the old Devonian lakes and seas. They are not made up of thin sheets like the other rocks, and seem as if made at a single cast. They are as rough-coated as alligators, and do not, to me, look as friendly as their brother rocks. They stand the fire better than other stone. The huge stone arch in my father's sugar bush, in which the great iron kettles were hung, was largely built of these stones. I think the early set-

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tlers used them to line the open fireplaces in their stone chimneys. Along the Hudson they used slate, which is also nearly fireproof.

I know a huge iron-stone rock lying at the foot of a hill, from beneath which issues one of the coldest and sweetest springs in the neighborhood. How the haymakers love to go there to drink, and the grazing cattle also! Of course, the relation of the rock to the spring is accidental. The rocks help make the history of the fields, especially the natural history. The woodchucks burrow beneath them, and trees and plants take root beside them. The delightful pools they often form in a trout-stream every angler remembers. Their immobility makes the mobile water dissolve and excavate the soil around and beneath them, and afford lairs for the big trout. I know of a large one that stood on the edge of the road where it snubbed the wagon-wheels as they came along. For generations it had defied the road-menders, till one June day a farmer of more pluck and endurance than usual tackled it with a heavy crowbar, and, after a prolonged effort, split off a huge slab from its top, making it, as the path-master said, "haul in its horns." When a boy I saw my elder brother drill a hole in one with a churn drill, and with a charge of powder blast it into four pieces, which were used in the foundation of a wall by the roadside. As I pass along that road now, after sixty-five years, I see the square faces of that rock with a

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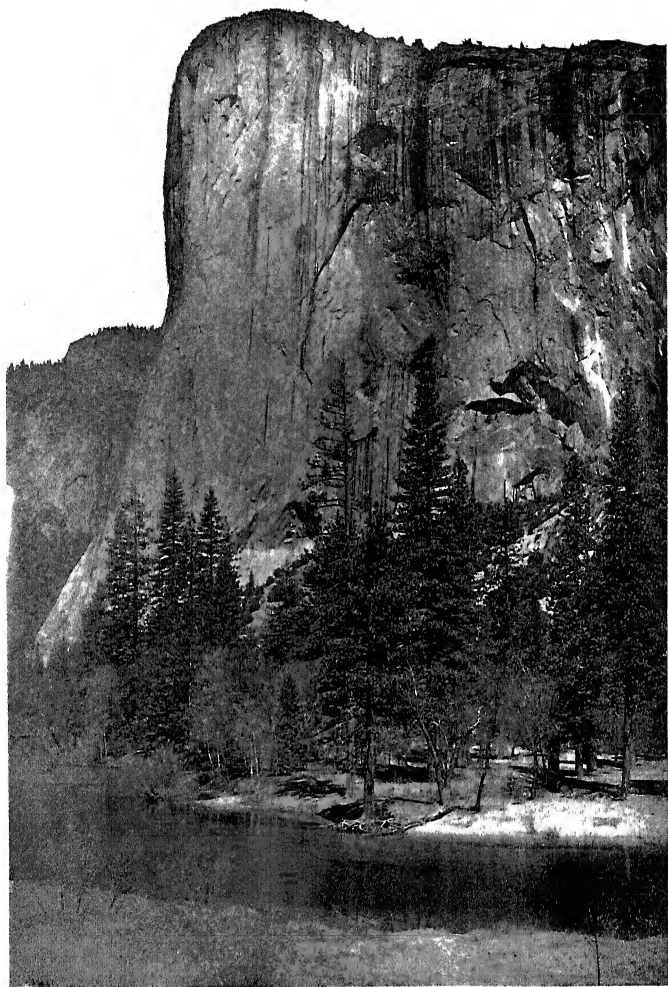
section of the drill-hole on the corner of each, and think of my brother. It was before the time of fuses, and I remember he primed the blast by the spindle method, and then laid a train of powder with a fragment of paper at the end of it. A lighted match was touched to the paper, and then we ran to a safe distance as fast as our legs could carry us.

How geologic time looks out from the ledges and walls of gray rocks unmindful of us human ephemera that pass! It has seen the mountains decay and the hills grow old. The huge drift boulders rest on the margin of meadows and fields, or stand sentry to the woods, and though races and kingdoms pass, scarcely the change of a wrinkle disturbs their calm stone faces. Yet time gets the better of them also. The frowning ledge melts as inevitably as a snow-bank.

Geologic time is the most potent of the gods of change. He wields an invisible hammer beside which the hammer of Thor is a child's toy. Its slow, silent blows break in through granite rocks as big as a house. The traveler sees them along the road when he enters Yosemite; he may see them in New England; he may see them on Lake Mohonk, or on the Shawangunk Mountains in New York — sheer cleavage of rock-masses from fifty to one hundred feet through — a clean break while the huge fragment of the mountain is lying where it fell. It is as if the sunbeams or starbeams did it, as if the

*“The very Iliad or Odyssey of the Rocks”*







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snows of winter and the dews of summer had the force of dynamite.

When I get especially rock-hungry, and the troglodyte in me gets restless, as he is apt to in all of us, I take a walk to the ledges on Pine Hill, or on Hemlock Ridge, and prowl about their caverns and loiter under their overhanging strata, putting my hand in the little niches and pockets where I kept my trinkets and choice possessions when I was a troglodyte, inspecting the phoebe's mossy nest on a little shelf where the four-footed beasts cannot reach it, cleaning out the spring that shows like a small eye under the rocky eyebrow, creeping through what we boys called the "Indian oven."

When you want to read a stirring and heroic chapter in the great rock volume of the earth, the very Iliad or Odyssey of the rocks, go to the Grand Cañon of the Colorado, or to Yosemite. As you gaze, a sentence from Job may come to your mind as it did to a friend of mine -- "Where wast thou when I laid the foundations of the earth?"

All through the Southwest the great book of geologic Revelation lies open to the traveler in an astonishing manner. Its massive but torn and crumpled leaves of limestone, sandstone, and basalt lie spread out before him all through Colorado, New Mexico, and Arizona, and he may read snatches of the long geologic record from the flying train.

I myself need not go so far to see what time can



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do with the rocks. On the Shawangunk range of mountains in my own State are scenes that suggest a rocky Apocalypse. It is as if the trumpet of the last day had sounded here in some past geologic time. The vast rock-strata of coarse conglomerate, hundreds of feet thick, has trembled and separated into huge blocks, often showing a straight, smooth cleavage like the side of a cathedral. As a matter of fact, I suppose there was no voice of the thunder or of earthquake that wrought this ruin, but the still small voice of heat and cold and rain and snow. There is no wild turmoil or look of decrepitude, but a look of repose and tranquillity. The enormous four-square fragments of the mountain stand a few feet apart, as if carefully quarried for a tower to reach the skies. In classic simplicity and strength, in harmony and majesty of outline, in dignity and serenity of aspect, I do not know their equal. They are truly Greek in their composure and restraint — impressive, like a tragedy of Æschylus, in their naked grandeur. No confusion of tumbled and piled fragments, no sublimity of wreckage and disorder, but the beauty of simplicity, the impressiveness of power in repose.

What a diverse family is this of the stratified rocks! Never did the members of the human family — Caucasian, Negro, Jew, Japanese, Indian, Eskimo, Mongolian — differ more from one another than do the successive geological formations. White

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and black, hard and soft, coarse and fine, red and gray, yet all in the same line of descent — all dating back to the same old Adam rock of the Azoic period. Time and circumstance, conditions of water and air, of sea and land, seem to have made the difference. As the races of men were modified and stamped by their environment, so the diverse family of rocks reflects the influence of both local and general conditions. When analyzed, their constituents do not differ so much. As in the different races of men we find the same old flesh and blood and bones, so in the rocks we find the same quartz sand and compounds of lime and iron and potash and magnesia and feldspar, yet in quantity and character what a world of difference! How differently they are bedded, how differently they weather, how differently they submit to the hammer and chisel of the mason and the stonecutter! Some rocks seem feminine, smooth, fine-grained, fragile, the product of deep, still water; others are more masculine, coarse, tough, the product of waters more or less turbid or shallow.

The purity of the strain of the different breeds of rocks is remarkable; about as little crossing or mingling among the different systems as there is among the different species of animals: considering the blind warring and chaos of the elements out of which they came, one can but wonder at the homogeneity of the different kinds. They are usually as uniform as if their production had been carefully

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watched over by some expert in the business, — which is, indeed, the case. This expert is water. Was there ever such a sorter and sifter? See the vast clay-banks, as uniform in quality and texture as a snow-bank, slowly built up in the privacy of deep, still rivers or lakes during hundreds or thousands of years, implying a kind of secrecy and seclusion of nature. Mountains of granite have been ground down or disintegrated, and the clay washed out and carried in suspension by the currents, till it was impounded in some lake or basin, and then slowly dropped. The great clay-banks and sand-banks of the Hudson River Valley doubtless date from the primary rocks of the Adirondack region. Much of the quartz sand is still in the soil of that region, and much of it is piled up along the river-banks, but most of the clay has gone downstream and been finally deposited in the great river terraces that are now being uncovered and worked by the brickmakers. The sand and the clay rarely get mixed; the great hydraulic machine turns out a pretty pure product. The occasional mingling of sand and gravel shows that at times the workmen nodded, but the wonder is that, on the whole, the two should be so thoroughly separated, and so carefully deposited, each by itself. Flowing water drops its coarser material first, the sand next, and the mud and silt last. Hence the coarser-grained rocks and conglomerates are built up in shallow water near shore, the

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sandstones in deeper water, and the slates and argillaceous rocks in deeper still. The limestone rocks, which are of animal origin, also imply deep, calm seas during periods that embrace hundreds and thousands of centuries. It is, then, the long ages of peace and tranquillity in the processes of the earth-building forces that have contributed to the homogeneity of the different systems of secondary rocks. What peace must have brooded over that great inland sea when those vast beds of Indiana limestone and sandstone were being laid down! A depth of thousands of feet of each without a flaw. Vast stretches of Cambrian and Silurian and Devonian time were apparently as free from violent movements and warrings of the elements as in our own day.

Occasionally in a system of rocks one may see a change of color over a considerable area, as from gray or brown to red, with small fragments of older and redder rocks embedded in them. I fancy such streaks were caused by a sudden flood or freshet that carried new material worn from a distant land-surface into the sea or into the impounded waters.

It would seem to require as distinctly an evolutionary process to derive our sedimentary rocks from the original igneous rocks as to derive the vertebrate from the invertebrate, or the mammal from the reptile. Of course, it could not be done by a mechanical process alone. It has been largely a chemical process and, no doubt, to a certain extent,

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a vital process also. The making of a loaf of bread is, up to a certain point, a mechanical process; then higher and finer processes set in. And all the cakes and pastry and loaves in the bakeshop do not differ from the original bin of wheat any more than the great family of secondary rocks differs from the unmilled harvest of the earth's original crust. And the increase in bulk seems to have been quite as great as that which the bin of wheat undergoes in passing from the kernel to the loaf or the roll. The leaven that went to the making of our shale and sandstone loaves seems to have been contributed by the sea when the batch was mixed and baked. Little doubt that the bulk of the material of the sedimentary rocks came through the process of erosion and deposition from the original igneous rocks, but how has it expanded and augmented during the process! It seems to have swelled almost as the inorganic swells in passing into the organic.

### III

## THE MASTER INSTINCT

FROM the naturalist's point of view, the sole purpose of all forms of life in this world, mankind, is to beget more life, and secure the perpetuity of the species. The master instinct in every creature is to increase and multiply and fill the world with its progeny. Our dream that every thing was made to serve some namable purpose apart from itself, or was designed in some way to give man, is a notion that has survived from the childhood of the race.

Many forms, in both the animal and the vegetable world, are the enemies of man and the enemies of each other. Other forms play into one another's hands, but only to help forward the scheme of propagation of one or both sides, as when vines and trees offer their seeds in tempting fruit-pulps which the animals eat and thus drop the undigested germs far and near. All our fruits, from the apple down to the strawberry, are plotting to get their seeds scattered and planted, and they offer edible morsels as a wage to any creature that will perform this service. In many cases the wage is a very small one, as with the holly, the cedar, the hardhack (*Celtis*), the sumac, the

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poison-ivy, and the like; but it serves the purpose; the hungry birds are quick to lend a hand. If the plants and vines and trees had minds and could answer our question as to what is passing in their lives they would say: "We are thinking how best to perpetuate our species — how to attract the insects to visit the flowers, and thus secure a hardier race by cross-fertilization; how to tempt the birds and four-footed creatures to come and sow our seeds; how to protect these seeds and nuts till they are ripe and ready to pass along the precious heritage of life; hence some of us trust to the winds and the water to secure fertilization, in which cases we do not need to develop bright or showy flowers, but a superabundance of pollen; for sowing our seeds, some of us devise wings and balloons; others devise hooks and hands that seize upon passing animals; others make use of the tension of springs and other mechanical devices. We heavy-nut-bearing trees enter into partnership with squirrels and crows and jays; they carry our nuts to distant woods and fields; some of them carelessly drop by the way, some they hide under the leaves or in the grass, and we find our account in each. They unwittingly plant more oak and chestnuts and hickory-trees."

Nearly all the animal orders below man are equally obsessed with the idea of perpetuating the species; for this they live, for this they die. It is a kind of madness; it leads to all kinds of excesses and

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extravagances: bizarre colors and ornaments, grotesque forms and weapons, fantastic rites and ceremonies. The sexual instinct emboldens the timid, and spurs the sluggard; it sharpens the senses, it quickens the wits, it makes even the frogs and toads musical, and gives new life to the turtle. In fact, the drama of all life revolves around the breeding-instinct. It is this that fills the world with music, color, perfume. The nuptials of the vegetable world are celebrated with lovely forms, brilliant hues, and sweet incense. With the birds they are attended by joyous songs, gay plumes, dances and festive reunions, and striking, if at times grotesque, forms. With the insects, music and gay colors mark the day; with the human race, how much of our song and art and pursuit of beauty has grown out of the instinct to please and win the opposite sex! Without this incentive — the mating instinct, the love of children, and of home and fireside — could we ever have attained to our present civilization?

What is the meaning of the spring and summer chorus of bird-songs — the ecstasy of larks and finches, the madness of nightingales, the melody of thrushes, the intoxication of bobolinks and mocking-birds — the jewels in the plumage, the fantastic in behavior — but sexuality, the innate desire for offspring? How Nature surrounds this passion with the gay, the festive, the hilarious! how she aids it with color and form! how she lavishes upon it all her



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arts to charm and persuade and entice! Her creatures forget their staid and quiet ways; there is a sound of music and gayety on the one hand, and a noise of strife and battle on the other. The stag bugles and tosses his horns, the bull bellows and tears and paws the earth, the grouse drums and booms, the woodpecker beats a spring reveille on a dry limb, the insects fiddle and shuffle and snap their wings — indeed, nearly all forms of life assume new activity and intensity.

It is the sex principle that gives the beard to the man, the antlers to the stag, the mane to the lion, the spurs and comb to the cock, and the strange fashions and coloration to the male birds. Reproduction is the one thing Nature has most at heart and is intent on securing at all hazards — at the hazard of pain, hunger, strife, and self-destruction.

Just to keep up the game of life, to keep the measure full to overflowing — has Nature any other purpose than this? Think of the swarms of the living that come and go, especially in the insect world, and leave no trace behind! Yes, and at times, in the higher-animal world. Think of the hordes of lemmings that at intervals appear in northern Europe, and move through the land devastating the farmers' crops, till they reach the sea, into which they plunge and are drowned. Ships are said to sail at times through miles of lemmings, swimming they know not whither.

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Behold the birds building their nests in spring; how absorbed, how persistent they are! How almost impossible it is to defeat or discourage them! Any one who has tried to prevent English sparrows from breeding on his premises soon learns what a difficult task he has undertaken. Equally, any one who charges himself to see to it that no burdocks or red-root, or other troublesome weeds, mature their seeds on his farm or about his grounds, finds out what enterprise and hardihood he is trying to thwart. Cut the plebeian burdock down within a few inches of the ground and keep it cut down, shorn of all its big leaves, and yet in August or September, without the support of any foliage, it will push out and develop burs in the axils of its old leaves. I have seen masses of burs thus form about the stem half as large as one's fist. The plant was making a last and supreme effort to perpetuate itself. Most garden weeds behave in the same way. As the summer nears its end, and their earlier efforts to form seeds have been thwarted, they seem to become alarmed, and to make a last heroic effort, probably drawing upon the last grain of material stored in the root and stalk to develop the precious germ.

Fruit-trees, starved or in an unhealthy condition, seem to be seized with the same alarm and overload themselves with small, inferior fruit. Is it not notorious that men and women suffering from certain slow, wasting diseases are exceptionally prolific? On

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the other hand, plants and animals overfed or exceptionally prosperous seem to forget the primal command.

The birds, I repeat, are not easily discouraged. In April of the past year a pair of phœbe-birds built their exquisite mossy nest in a niche in the rocks at the entrance to my natural cellar at Slabsides. It was a nest in the best style of the phœbe's art, built unhurriedly, as all first nests of the season usually are. Like the plant, the bird does not hurry till the season gets late. One snow-white egg was laid, when, on a visit to me of some schoolboys, the nest accidentally came to grief; it was detached from the rock upon which the bird had so carefully masoned it. I replaced the nest, but its foundations had been loosened, and the winds dislodged it. The phœbes then began a nest on a timber under the little shed. One day I found this dislodged and its material pulled apart on the ground beneath. Who or what Vandal or Hun of the woods did it, whether a red squirrel or an owl or other violator of its neighbor's rights, I know not. But the phœbes did not lose heart. When I discovered the second calamity that had befallen them, they were already at work building the third nest, and — what was very unusual — were using the material of the nest just destroyed. Bit by bit the mother bird was gathering it up and reconstructing her "procreant cradle." I hoped a third disaster would not befall the pair, and it did not,

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but if it had, not later than June, they would probably have built still another nest. The phalaropes usually rear two broods in a season when all goes well with them. It is to build the nest and rear the young that they have made the long and hazardous journey from our Southland, or even from Central America, and it is this that will cause them to make it every spring as long as they live. It is this that impels myriads of other small birds and water-fowl to make the same trip from the Far South, braving storms and winds and other perils by land and sea. To beget progeny that will in time reproduce themselves is the unconscious and unquenchable motive that actuates them all. This same motive impels the golden plover to make its marvelous flight from the plains of Patagonia to the Arctic Circle in Alaska, a distance of nearly half the circumference of the globe, crossing oceans without a rest. It sends the European migrants across the Mediterranean from Africa to France, many of them so fatigued on reaching land that they fall an easy prey to man and beast.

It is the impelling force of this motive or instinct that sends the fish up the streams and rivers in the spring, making the waters alive with denizens from the sea, impelling the salmon to leap falls, or, failing to scale them, to keep up the effort till they die from exhaustion. The breeding-instinct is the ruler of life. It asks no questions, it requires no guarantee, it

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pauses at no obstacles. It sends races of men and animals to seek new lands; it fills nations with the desire for expansion, kindles in them the earth-hunger, and is often the chief factor in devastating wars.

In man the sexual passion is stronger than all others; it rules his life, it has made his history. Consciously or unconsciously, he lives for his posterity. He wages wars to plant colonies or to conquer territory from his enemies, in which his race may expand and increase. His eye is ever on the future; he is looking out for his children and his children's children. Nine tenths of the life of woman centres around the idea of making herself attractive to the opposite sex. This is the meaning of all the modes and fashions — of the monstrous hats, the hobble-skirts, the preposterous shoes, the paint, the jewelry, the feathers, the frippery and the furbelows, the immodest exposures, the exaggerations and accentuations, and all the bewildering arts and devices by which woman seeks to enhance her feminine charms.

The social dances, old and new, though the participants may be all unconscious of it, are as literally sexual, and have as direct reference to the old command to be fruitful and multiply and replenish the earth, as do the dances and aerial evolutions of the birds and the wild fowl. Fine clothes, like fine feathers, all point in the same direction. Male pride

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and female pride do not differ in their genesis or natural history from the pride displayed in barnyards and in the fields and woods — it is all the outcome of the old command to increase and multiply — it is the masterful desire of one sex to make itself attractive to the opposite.

A great number of insect forms die as soon as they have fulfilled the Biblical injunction. This is true of all the ephemera, and at least one form of vertebrates, the lampreys; these perish as soon as they have spawned.

The cockchafer dies in a month after completing its metamorphosis. The seventeen-year locusts and the grasshoppers live but a short time after they have deposited their eggs. Nature has no further use for them. Many of the moths deposit their eggs within twenty-four hours after they escape from the chrysalis-case, and then very soon die. Many kinds of flies live only four or five hours — just long enough to lay their eggs. As soon as a drone of the hive-bee has fertilized the queen, the swarm has no further use for the whole tribe of drones and they are mercilessly killed or expelled from the hive. Nature displays the same superabundance of the fertilizing principle in such cases that she does in the trees and plants that cast their pollen upon the wind. This is to offset the element of chance. The services of only one drone is required, but the swarm develops scores of them to make sure that at least one male

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may meet the queen while she is coursing at random on her nuptial flight through the upper air.

Speaking of the queen of the hive-bee reminds me how literally the life of the hive revolves around *her*. The queen's moral support of the swarm, so to speak, is vital. If any accident befall her, in the case of a new swarm before it has established itself, the whole mass of worker bees instantly becomes demoralized; the swarm loses heart, and gradually perishes without making any attempt to start a new colony. The members seem to know instinctively that there can be no increase, and that their own lives are worthless.

I have seen the whole swarm, when it was suddenly discovered that the queen was missing, show the greatest agitation, every individual insect rushing about with quivering body and wings, in a panic of alarm. What one bee knew and felt, apparently the whole swarm knew and felt simultaneously.

It is worthy of note that though it costs the drone his life to fertilize the queen, dozens of them course through the air during the period that the mating-flight of the queen is due to take place, ready to sacrifice themselves in performing this duty. Alike with drone, worker, queen, the paramount instinct is the perpetuity of the race.

So careless of the male of most species is Nature, so solicitous for the well-being of the female! The function of the male is a brief one, that of the female

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a long and hazardous one. Among birds of prey the female is the larger, the bolder, and the more active. The parental instinct seems much stronger in her than in the male.

The breeding-instinct has developed among the birds, especially among the ground-builders, one of the most surprising traits or practices to be found in all animate nature. I refer to the tricks and the make-believe that birds will resort to in order to decoy one away from their nests or their young — feigning lameness, paralysis, suffocation, anything to fix the attention of the intruder upon the mother and lure him away from her precious eggs or young. I can recall nothing else so extraordinary in the whole range of animal instinct. The bird suddenly becomes a consummate actor and plays a rôle she probably never played before, and plays it in the best style of the art. Her behavior looks like the outcome of a sudden process of reasoning. "This creature," it seems to say, "wants my brood, but I will make him want me, and forget the brood. To do so, I have only to throw myself in his way and offer him an easy victim. By my feigned disablement I can draw him on and on, while my young hide, or the clue to my nest is lost."

Last spring in a low, wooded bottom in Georgia, my friend and I started a woodcock from her nest, in which were three eggs. The bird flew a few yards, at a height of ten feet or more, and then suddenly



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doubled up and fell fluttering to the ground precisely as if she had been shot. It was a superb performance. It is highly probable that it was the first time she ever did the trick, but she did it with perfect execution. Had we followed her, doubtless she would have given us another exhibition of her art or of her power to believe.

Strange to say, after all her concern for the safety of her eggs, the bird deserted her nest. My friend suggested that it was because we touched on the subject of eggs; but, as birds have little or no powers of reasoning, this reason seems inadequate. Rather am I inclined to believe that some accident befell the bird.

Equally surprising is it to see this stupid-mud-prober transformed into an ecstatic songster under the influence of the mating-instinct. We have witnessed its hurried spiral flight in the early morning and April twilights, and heard its curious smothered gurgling notes rain down out of the obscurity of a couple of hundred feet of air, has been present at some of the surprising incidents in the life of this bird.

Love not only makes the songless woodcock sing, but it puts a new song into the throats of many other birds. The oven-bird, the meadowlark, the robin, the finch, the goldfinch, and certain of the sparrows and warblers are keyed up to the point where the song, or song of ecstasy, is the natural expression of the bird soul. The jays and crows also are musical, and the woodpeckers drum in varying

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on the resonant limbs. This marked contrast between their ordinary tones and their love-songs reminds one of Browning's lines: —

“God be thanked, the meanest of his creatures  
Boasts two soul-sides, one to face the world with,  
One to show a woman when he loves her!”

In the vegetable world the males of dioecious plants perish as soon as the period of bloom of the females, or pistillate plants, has passed. Our spring plant called mouse-ear and everlasting (*Antennaria*) is a familiar example. The two sexes are in separate groups, and show a marked difference in their appearance. The pistillate plants have a feminine look, they are more slender and graceful, and show more color; they differ in looks from the males as much as the queen bees differ from the drones. The males are short, stubby, freckled, and after they have shed their pollen they wither and perish, while the females continue to develop and grow in grace and beauty till their seeds are matured. The same is true with all shrubs and trees — hazels, chestnuts, oaks, beeches — which develop their pollen in catkins or aments; as soon as the pollen is shed upon the inconspicuous flowers the catkins wither and fall.

There is no case of love and mating among the plants more pleasing to me than that of our Indian corn. When I see the male blossom push its panicle

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up out of the top of the stalk, bold, rigid, conspicuous, rustic-looking, — “topping out,” as the farmers say, — and then, following down the stalk with my eye, see among the leaves the female blossom timidly putting out her delicate silk fringe, like a lock of greenish-golden hair, — one tender thread for each kernel of corn that is to be, — and awaiting the caresses through the agency of the wind of her suitor above, I am witnessing one of the most pleasing illustrations of Nature’s great law that is to be seen in our fields and gardens.

In the case of no other tree in our Northern forests does the male principle assert itself so conspicuously as in the chestnut—a tree that now, alas! seems in danger of extinction from some obscure fungus disease attacking its inner bark. In early summer its masses of creamy-white staminate flowers make the top of the woods gay, while its small, modest, greenish female flowers are seen only by him who closely searches for them. But the gala day of the males is brief, while the obscure mother-bloom goes forward and develops her polished triple nuts of autumn.

The odors of the blooming corn and blooming chestnut in some way suggest fruition and the sex passion.

In the hazel, masculine and feminine contrast in the same way as in the chestnut. The long, showy, pollen-yielding tassels are seen from afar, but the

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minute crimson stars of the nut-producing flowers you will not see without close inspection. Thus do sex characteristics run throughout organic nature. Whitman speaks of the sexuality of the earth, having in mind, no doubt, its fertility and the passive feminine relation it sustains to the orbs above.

Truly the breeding-instinct, with the whole train of subsidiary instincts that go with it, is close to Nature's heart, closer than the instinct of self-preservation. Life is conserved only that it may produce more life. In the insect world, certain forms utterly exhaust themselves in the art of reproduction; others in the act of providing housing and food for their unborn offspring. The May-fly develops into winged liberty, experiences the love-festival, deposits its eggs, when both sexes die, all within the compass of a few hours. Of some species of thread-worms it is said that "the young live at the expense of the mother till she is reduced to a mere husk." Fabre tells us of a species of dung-beetle the male of which scours the fields for food for the young, which he carries home and, with his trident, reduces to a powder, till, after the labor of months, without nourishment himself, he becomes utterly exhausted and dies.

In eating up her lover after he has served her purpose, the female spider seems to be carrying domestic economy to unwarranted lengths. Yet generation after generation of male spiders court the

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female, though often with obvious signs of hesitancy and trepidation. Love overcomes the lover's fear of the ferocious jaws of his mistress. The same is true of the praying-mantis and the scorpion, as portrayed by the inimitable Fabre. After hours or days of love and nuptial bliss, the female turns and slays her lover, and makes a meal off him. The human, or, rather, inhuman, Bluebeard is matched on the other side of the house. Love and martyrdom go hand in hand with honey-bees, spiders, and scorpions. Eating up your mate is certainly a simple and primitive way out of matrimonial difficulties.

Is it not probable that in all such cases the female obtains some nutritive element, maybe in minute quantities, from the body of the male that is necessary for the complete development of her young? The purpose of Nature must be served in some way in such a tragedy, as it is when certain species eat the placenta and when the toad devours his cast-off skin.

Weismann has suggested that the bodies of animals are but appendages to the immortal chain of sex cells — they are only the vessels in which the precious germs are nourished and conveyed, the body bearing the relation to them of host to parasite.

So solicitous is Nature for the well-being of the offspring that she will rob the mother's body, if insufficiently nourished, to feed the baby she is car-

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rying in her womb. If the laying hen is not properly supplied with lime material, Nature will draw it from the bones of the hen herself to build the shell of the egg. The offspring is first always, and has the right of way over all else. In short, the struggle to live in the whole organic world resolves itself into the struggle to have and to rear offspring. This is

"the one divine event  
Toward which the whole creation moves."